XC61C Series

ETR0201_015

Low Voltage Detectors (V_{DF}= 0.8V～1.5V)
Standard Voltage Detectors (V_{DF} 1.6V～6.0V)

■GENERAL DESCRIPTION

The XC61C series are highly precise, low power consumption voltage detectors, manufactured using CMOS and laser trimming technologies.
Detect voltage is extremely accurate with minimal temperature drift.
Both CMOS and N-ch open drain output configurations are available.

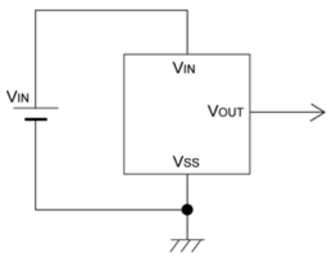
■APPLICATIONS

- ●Microprocessor reset circuitry
- ●Memory battery back-up circuits
- ●Power-on reset circuits
- ●Power failure detection
- ●System battery life and charge voltage monitors

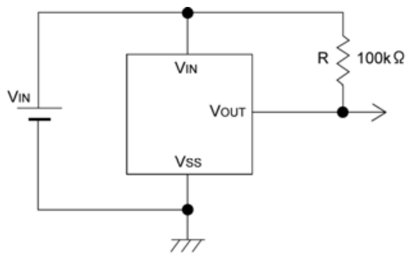
■FEATURES

Highly Accurate : ± 2%
: ± 1%(Standard Voltage VD: 2.6V~5.1V)
Low Power Consumption : 0.7 μA (TYP.) [V_{IN}=1.5V]
Detect Voltage Range : 0.8V ~ 6.0V in 0.1V increments
Operating Voltage Range : 0.7V ~ 6.0V (Low Voltage)
0.7V～10.0V (Standard Voltage)
Detect Voltage Temperature Characteristics
: ±100ppm/℃ (TYP.)
Output Configuration : N-ch open drain or CMOS
Packages : SSOT-24
SOT-23
SOT-89
TO-92
Environmentally Friendly : EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUITS



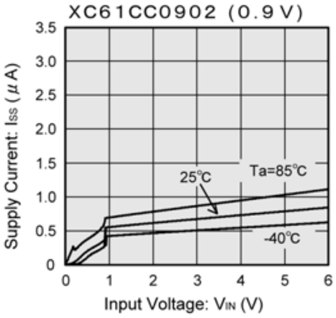
CMOS Output



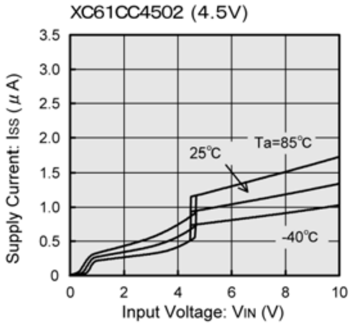
N-ch Open Drain Output

■TYPICAL PERFORMANCE CHARACTERISTICS

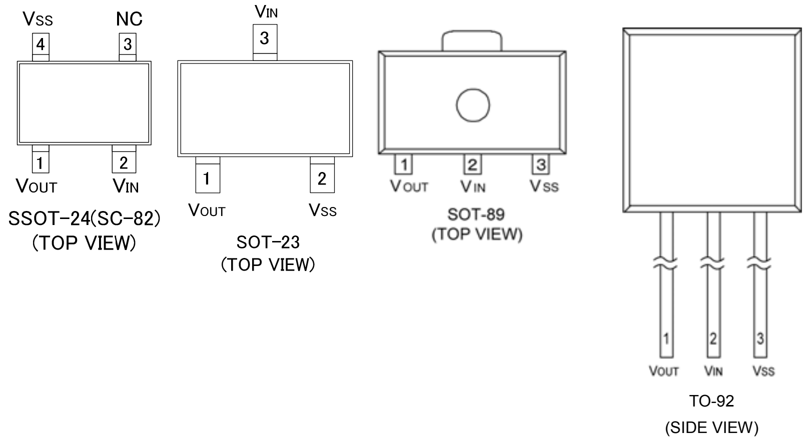
Supply Current vs. Input Voltage
XC61CC0902 (0.9V)



Supply Current vs. Input Voltage
XC61CC4502 (4.5V)



■PIN CONFIGURATION



■PIN ASSIGNMENT

PIN NUMBER				PIN NAME	FUNCTION
SSOT-24	SOT-23	SOT-89	TO-92		
2	3	2	2	V_{IN}	Supply Voltage Input
4	2	3	3	V_{SS}	Ground
1	1	1	1	V_{OUT}	Output
3	-	-	-	NC	No Connection

■PRODUCT CLASSIFICATION

●Ordering Information

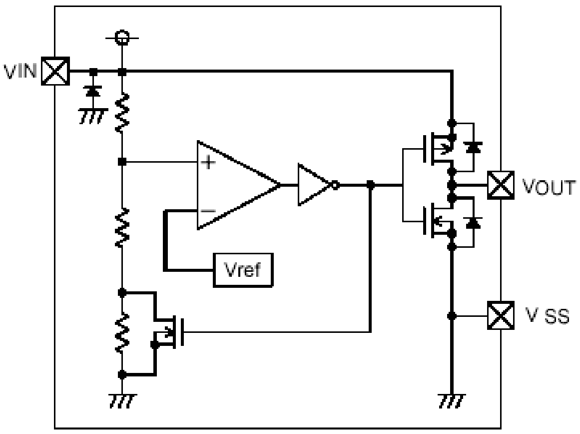
XC61C①②③④⑤⑥⑦-⑧ (*1)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Output Configuration	C	CMOS output
		N	N-ch open drain output
②③	Detect Voltage	08 ~ 60	e.g.0.9V → ②0, ③9
			e.g.1.5V → ②1, ③5
④	Output Delay	0	No delay
⑤	Detect Accuracy	1	Within ±1% ($V_{DF(T)}$=2.6V~5.1V)
		2	Within ±2%
⑥⑦-⑧ (*1)	Packages (Order Unit)	NR	SSOT-24 (SC-82) (3,000/Reel)
		NR-G	SSOT-24 (SC-82) (3,000/Reel)
		MR	SOT-23 (3,000/Reel)
		MR-G	SOT-23 (3,000/Reel)
		PR	SOT-89 (1,000/Reel)
		PR-G	SOT-89 (1,000/Reel)
		TH	TO-92 Taping Type: Paper type (2,000/Tape)
		TH-G	TO-92 Taping Type: Paper type (2,000/Tape)
		TB	TO-92 Taping Type: Bag (500/Bag)
		TB-G	TO-92 Taping Type: Bag (500/Bag)

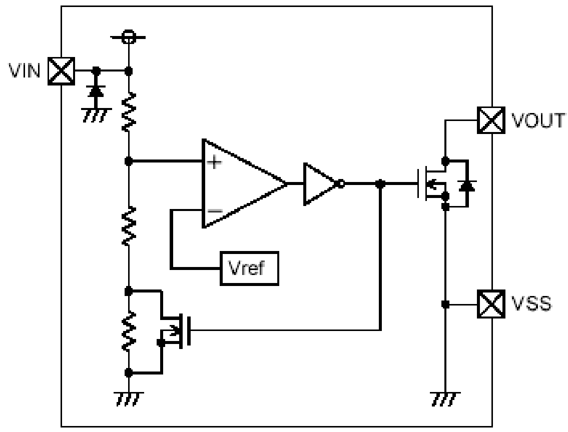
(*1) The “-G” suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

■BLOCK DIAGRAMS

(1) CMOS Output



(2) N-ch Open Drain Output



■ABSOLUTE MAXIMUM RATINGS

Ta = 25°C

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage	*1	VIN	V_{SS}-0.3 ~ 9.0	V
	*2		V_{SS}-0.3 ~ 12.0	
Output Current		IOUT	50	mA
Output Voltage	CMOS	VOUT	V_{SS} -0.3 ~ V_{IN} +0.3	V
	N-ch Open Drain Output *1		V_{SS} -0.3 ~ 9.0	
	N-ch Open Drain Output *2		V_{SS} -0.3 ~ 12.0	
Power Dissipation	SSOT-24	Pd	150	mW
	SOT-23		150	
	SOT-89		500	
	TO-92		300	
Operating Temperature Range		Topr	-40～+85	℃
Storage Temperature Range		Tstg	-40～+125	℃

*1: Low voltage: $V_{DF(T)}$=0.8V~1.5V
*2: Standard voltage: $V_{DF(T)}$=1.6V~6.0V

■ELECTRICAL CHARACTERISTICS

$V_{DF(T)}$ = 0.8V to 6.0V ± 2%

$V_{DF(T)}$ = 2.6V to 5.1V ± 1%

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUITS
Detect Voltage	V_{DF}	$V_{DF(T)}$=0.8V~1.5V *1 $V_{DF(T)}$=1.6V~6.0V *2	$V_{DF(T)}$ x 0.98	$V_{DF(T)}$	$V_{DF(T)}$ x 1.02	V	1
		$V_{DF(T)}$=2.6V~5.1V *2	$V_{DF(T)}$ x 0.99	$V_{DF(T)}$	$V_{DF(T)}$ x 1.01	V	1
Hysteresis Range	V_{HYS}		V_{DF} x 0.02	V_{DF} x 0.05	V_{DF} x 0.08	V	1
Supply Current	I_{SS}	V_{IN} = 1.5V	-	0.7	2.3	μA	2
		V_{IN} = 2.0V	-	0.8	2.7		
		V_{IN} = 3.0V	-	0.9	3.0		
		V_{IN} = 4.0V	-	1.0	3.2		
		V_{IN} = 5.0V	-	1.1	3.6		
Operating Voltage *1	V_{IN}	$V_{DF(T)}$ = 0.8V to 1.5V	0.7	-	6.0	V	1
Operating Voltage *2		$V_{DF(T)}$ = 1.6V to 6.0V	0.7	-	10.0		
Output Current *1	I_{OUT}	N-ch V_{DS} = 0.5V, V_{IN} = 0.7V	0.10	0.80	-	mA	3
		N-ch V_{DS} = 0.5V, V_{IN} = 1.0V	0.85	2.70	-		
		CMOS, P-ch V_{DS} = 2.1V, V_{IN} = 6.0V	-	-7.5	-1.5		4
Output Current *2		N-ch V_{DS} = 0.5V, V_{IN} = 1.0V	1.0	2.2	-		3
		N-ch V_{DS} = 0.5V, V_{IN} = 2.0V	3.0	7.7	-		
		N-ch V_{DS} = 0.5V, V_{IN} = 3.0V	5.0	10.1	-		
		N-ch V_{DS} = 0.5V, V_{IN} = 4.0V	6.0	11.5	-		
		N-ch V_{DS} = 0.5V, V_{IN} = 5.0V	7.0	13.0	-		
		CMOS, P-ch V_{DS} = 2.1V, V_{IN} = 8.0V	-	-10.0	-2.0		4
Leakage Current: CMOS Output (Pch)	I_{LEAK}	V_{IN}=V_{DF}x0.9, V_{OUT}=0V	-	-10	-	nA	3
Leakage Current: N-ch Open Drain		V_{IN}=6.0V, V_{OUT}=6.0V *1 V_{IN}=10.0V, V_{OUT}=10.0V *2	-	10	100		
Temperature Characteristics	ΔV_{DF}/ (ΔTopr·V_{DF})	-40℃ ≦ Topr ≦ 85℃	-	±100	-	ppm/℃	1
Delay Time (V_{DR}→V_{OUT} inversion)	t_{DLY}	Inverts from V_{DR} to V_{OUT}	-	0.03	0.20	ms	5

NOTE:
*1: Low Voltage: $V_{DF(T)}$=0.8V~1.5V
*2: Standard Voltage: $V_{DF(T)}$=1.6V~6.0V
$V_{DF(T)}$: Nominal detect voltage
Release Voltage: V_{DR} = V_{DF} + V_{HYS}

■OPERATIONAL EXPLANATION

(Especially prepared for CMOS output products)

① When input voltage (V_{IN}) is higher than detect voltage (V_{DF}), output voltage (V_{OUT}) will be equal to VIN.
(A condition of high impedance exists with N-ch open drain output configurations.)

② When input voltage (V_{IN}) falls below detect voltage (V_{DF}), output voltage (V_{OUT}) will be equal to the ground voltage (V_{SS}) level.

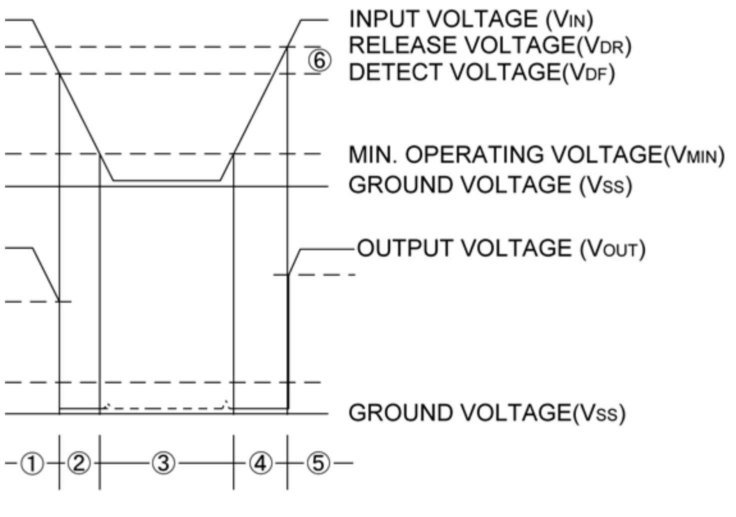
③ When input voltage (V_{IN}) falls to a level below that of the minimum operating voltage (V_{MIN}), output will become unstable. (As for the N-ch open drain product of XC61CN, the pull-up voltage goes out at the output voltage.)

④ When input voltage (V_{IN}) rises above the ground voltage (V_{SS}) level, output will be unstable at levels below the minimum operating voltage (V_{MIN}). Between the V_{MIN} and detect release voltage (V_{DR}) levels, the ground voltage (V_{SS}) level will be maintained.

⑤ When input voltage (V_{IN}) rises above detect release voltage (V_{DR}), output voltage (V_{OUT}) will be equal to V_{IN}.
(A condition of high impedance exists with N-ch open drain output configurations.)

⑥ The difference between V_{DR} and V_{DF} represents the hysteresis range.

●Timing Chart



■NOTES ON USE

1. Please use this IC within the stated absolute maximum ratings. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. When a resistor is connected between the V_{IN} pin and the power supply with CMOS output configurations, oscillation may occur as a result of voltage drops at R_{IN} if load current (I_{OUT}) exists. (refer to the Oscillation Description (1) below)
3. When a resistor is connected between the V_{IN} pin and the power supply with CMOS output configurations, irrespective of N-ch open-drain output configurations, oscillation may occur as a result of through current at the time of voltage release even if load current (I_{OUT}) does not exist. (refer to the Oscillation Description (2) below)
4. Please use N-ch open drain output configuration, when a resistor R_{IN} is connected between the V_{IN} pin and power source. In such cases, please ensure that R_{IN} is less than 10kΩ and that C is more than 0.1μF, please test with the actual device. (refer to the Oscillation Description (1) below)
5. With a resistor R_{IN} connected between the V_{IN} pin and the power supply, the V_{IN} pin voltage will be getting lower than the power supply voltage as a result of the IC's supply current flowing through the V_{IN} pin.
6. In order to stabilize the IC's operations, please ensure that V_{IN} pin input frequency's rise and fall times are more than 2 μ s/ V.
7. Torex places an importance on improving our products and its reliability.
   However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

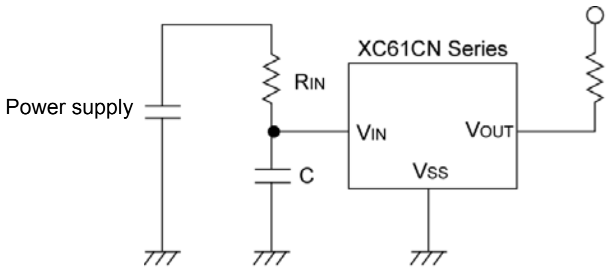


Figure 1: Circuit using an input resistor

●Oscillation Description

(1) Load current oscillation with the CMOS output configuration

When the voltage applied at power supply, release operations commence and the detector's output voltage increases. Load current (I_{OUT}) will flow at R_L. Because a voltage drop (R_{IN} x I_{OUT}) is produced at the R_{IN} resistor, located between the power supply and the V_{IN} pin, the load current will flow via the IC's V_{IN} pin. The voltage drop will also lead to a fall in the voltage level at the V_{IN} pin. When the V_{IN} pin voltage level falls below the detect voltage level, detect operations will commence. Following detect operations, load current flow will cease and since voltage drop at R_{IN} will disappear, the voltage level at the V_{IN} pin will rise and release operations will begin over again.
Oscillation may occur with this " release - detect - release " repetition.
Further, this condition will also appear via means of a similar mechanism during detect operations.

(2) Oscillation as a result of through current

Since the XC61C series are CMOS IC s, through current will flow when the IC's internal circuit switching operates (during release and detect operations). Consequently, oscillation is liable to occur as a result of drops in voltage at the through current's resistor (R_{IN}) during release voltage operations. (refer to Figure 3)
Since hysteresis exists during detect operations, oscillation is unlikely to occur.

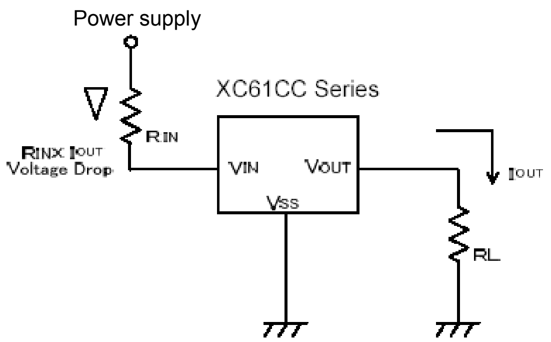


Figure 2: Oscillation in relation to output current

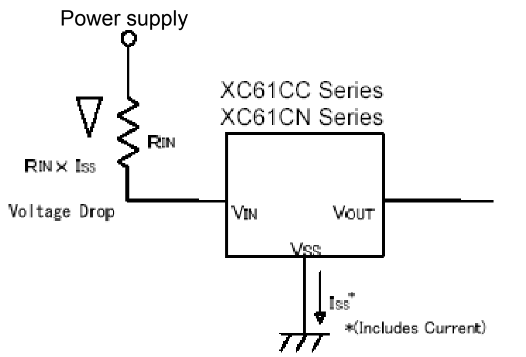
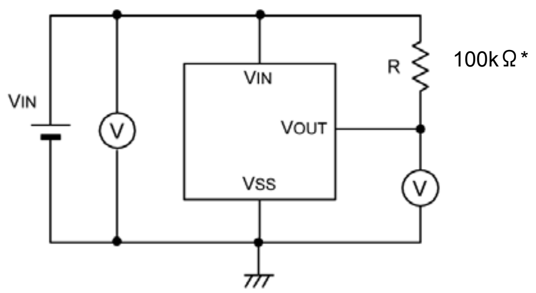


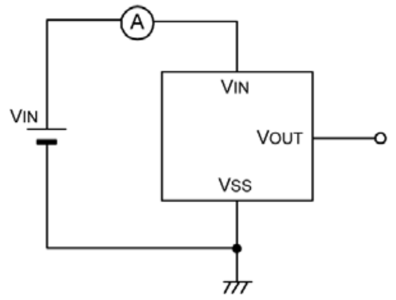
Figure 3: Oscillation in relation to through current

■ TEST CIRCUITS

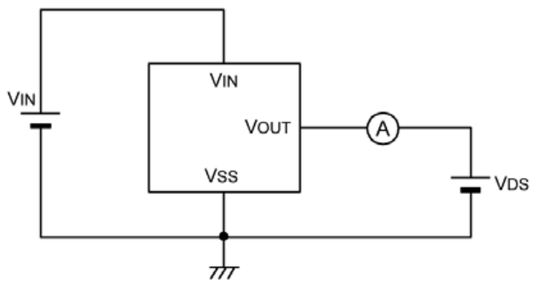
Circuit 1



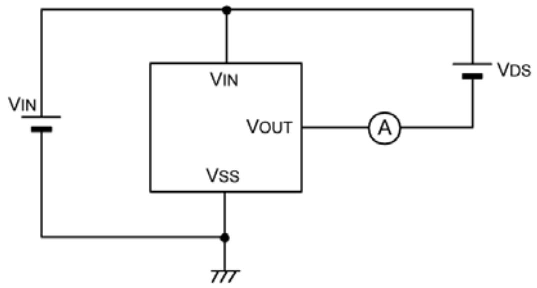
Circuit 2



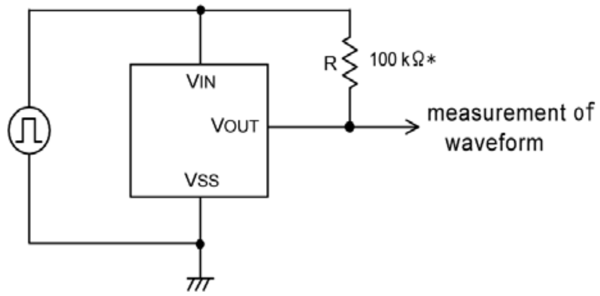
Circuit 3



Circuit 4



Circuit 5



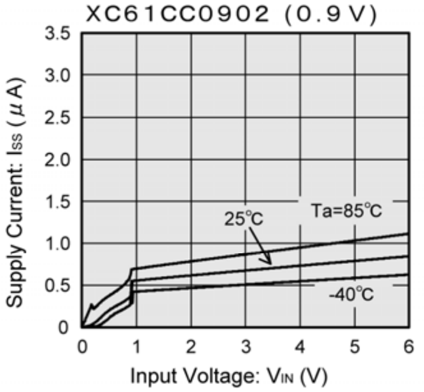
* : A resistor is not necessary with CMOS output products.

■TYPICAL PERFORMANCE CHARACTERISTICS

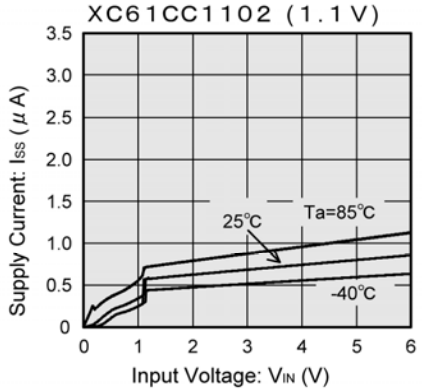
●Low Voltage

(1) Supply Current vs. Input Voltage

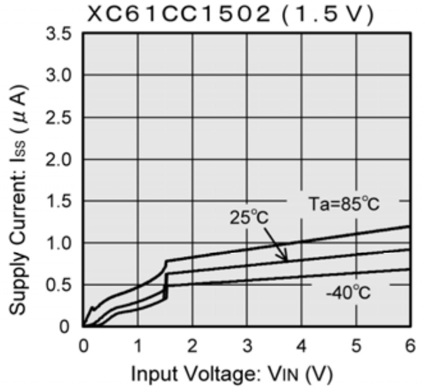
XC61CC0902 (0.9V)



XC61CC1102 (1.1V)

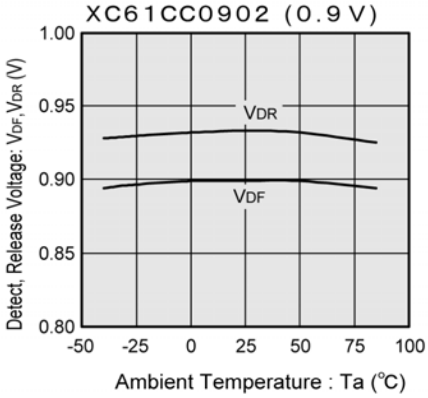


XC61CC1502 (1.5V)

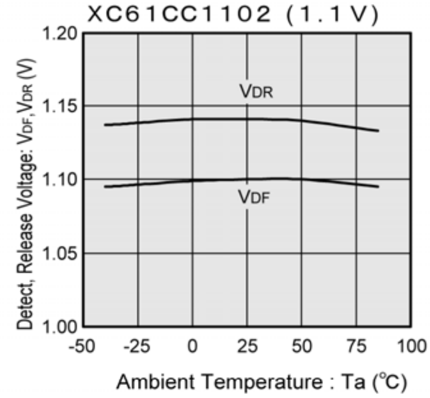


(2) Detect, Release Voltage vs. Ambient Temperature

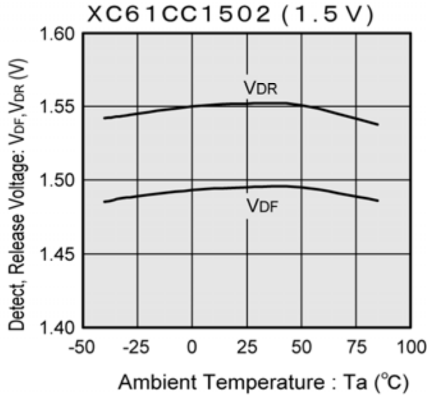
XC61CC0902 (0.9V)



XC61CC1102 (1.1V)

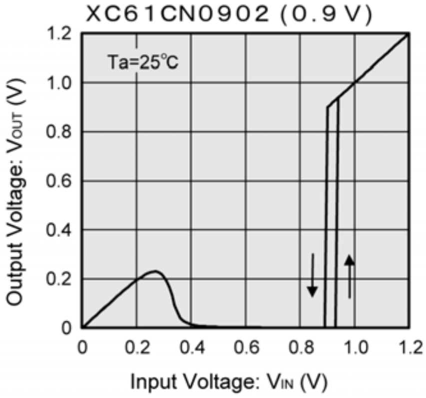


XC61CC1502 (1.5V)

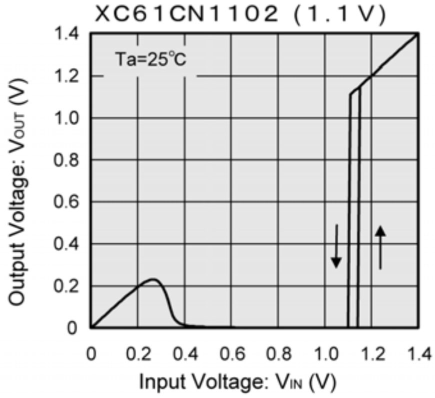


(3) Output Voltage vs. Input Voltage

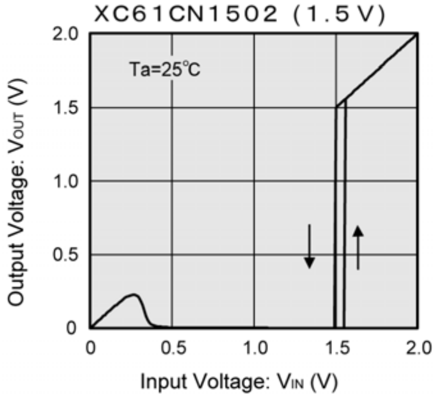
XC61CN0902 (0.9V)



XC61CN1102 (1.1V)



XC61CN1502 (1.5V)



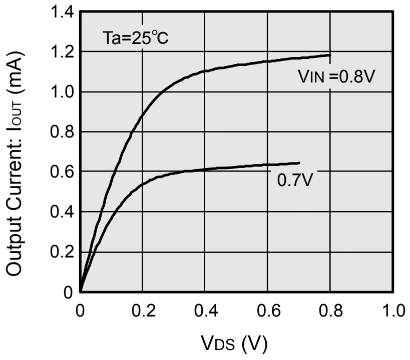
Note : Unless otherwise stated, the N-ch open drain pull-up resistance value is 100kΩ.

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

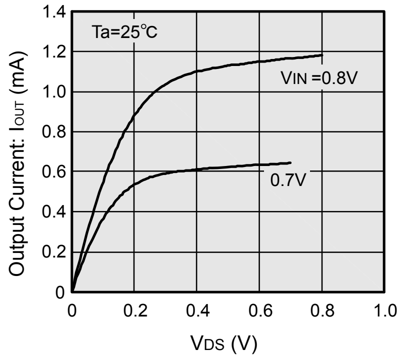
●Low Voltage (Continued)

(4) N-ch Driver Output Current vs. VDS

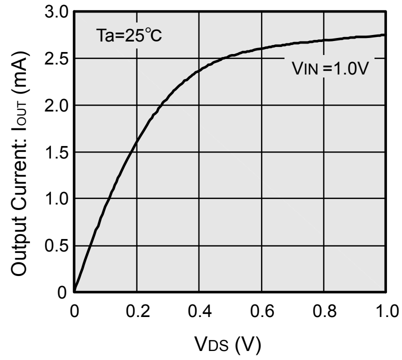
XC61CC0902 (0.9V)



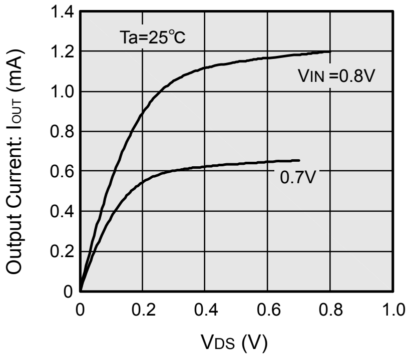
XC61CC1102(1.1V)



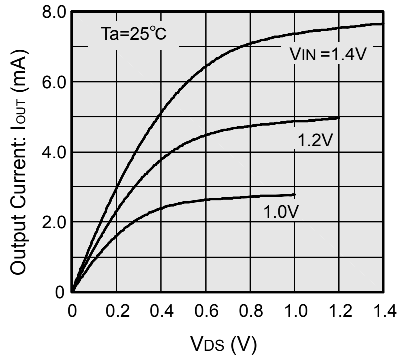
XC61CC1102(1.1V)



XC61CC1502(1.5V)

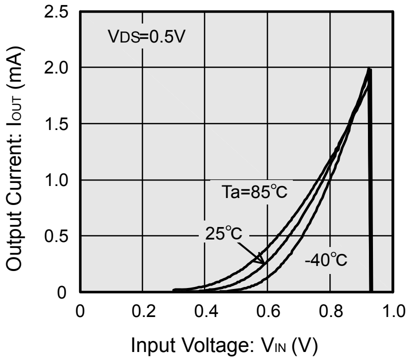


XC61CC1502(1.5V)

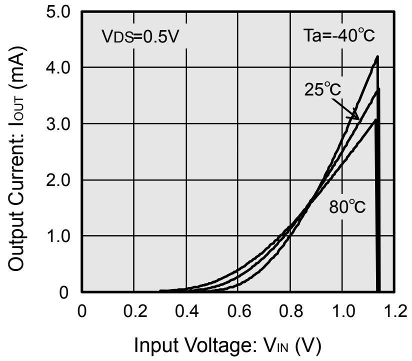


(5) N-ch Driver Output Current vs. Input Voltage

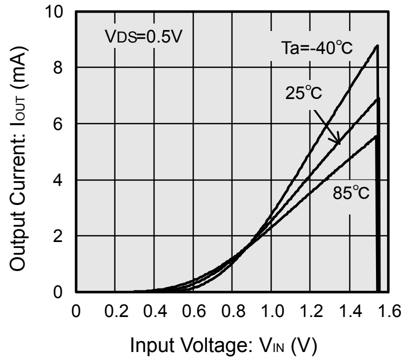
XC61CC0902 (0.9V)



XC61CC1102 (1.1V)

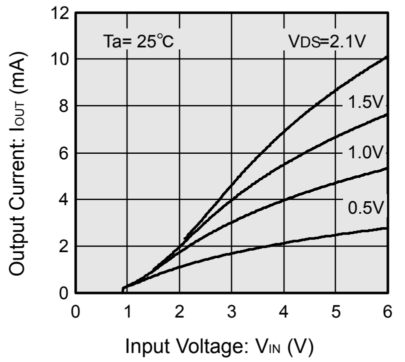


XC61CC1502(1.5V)

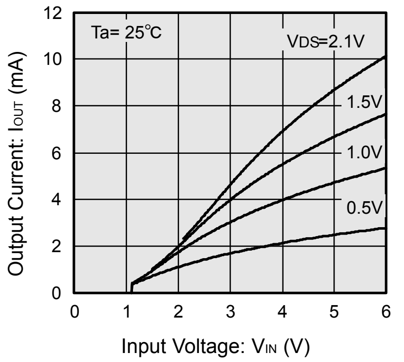


(6) P-ch Driver Output Current vs. Input Voltage

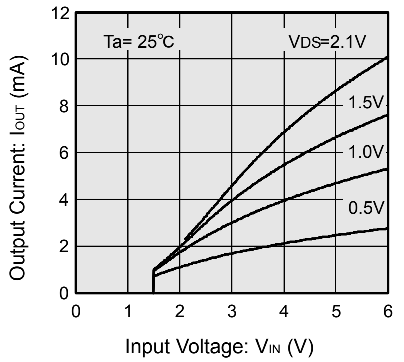
XC61CC0902 (0.9V)



XC61CC1102 (1.1V)



XC61CC1502(1.5V)

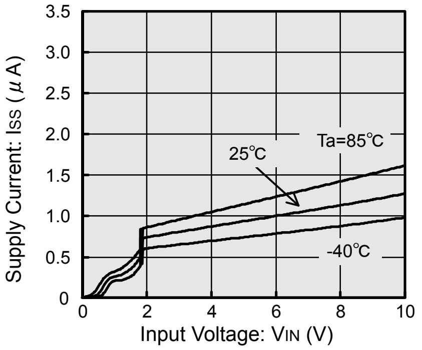


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

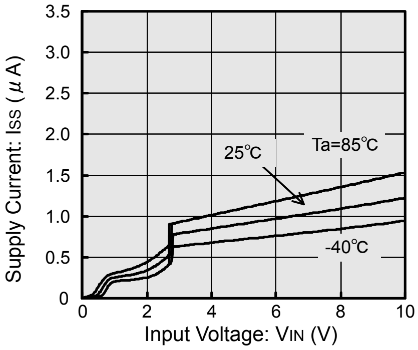
●Standard Voltage

(1) Supply Current vs. Input Voltage

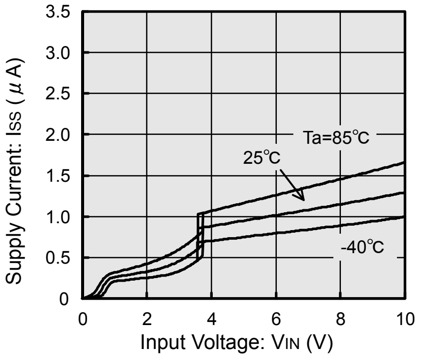
XC61CC1802 (1.8V)



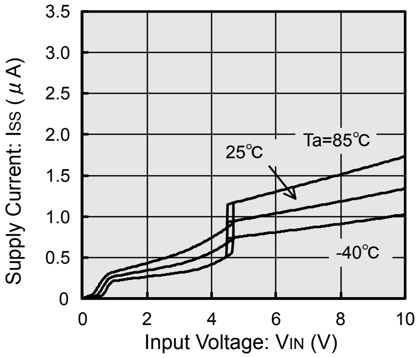
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)

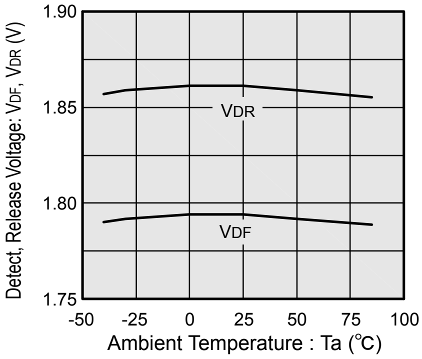


XC61CC4502 (4.5V)

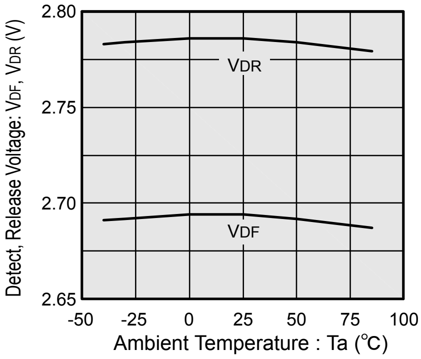


(2) Detect, Release Voltage vs. Ambient Temperature

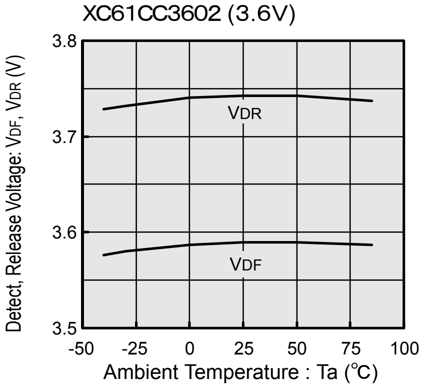
XC61CC1802 (1.8V)



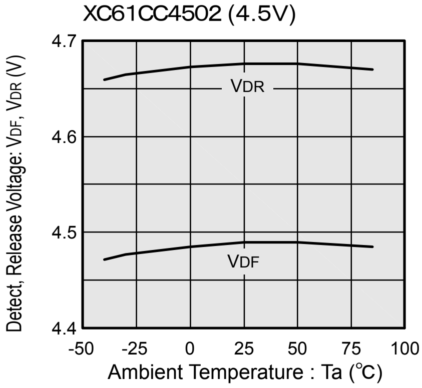
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)



XC61CC4502 (4.5V)

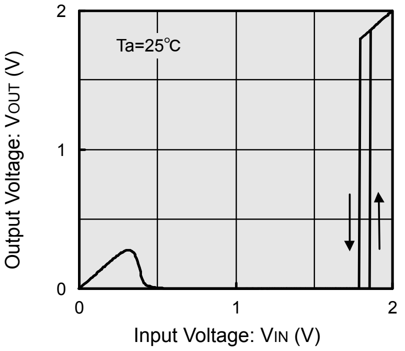


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

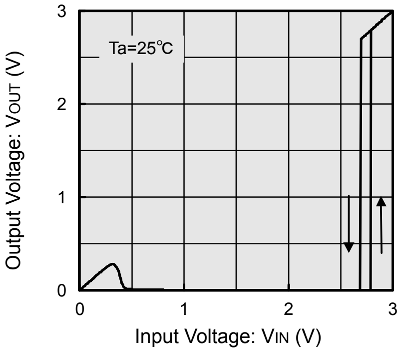
●Standard Voltage (Continued)

(3) Output Voltage vs. Input Voltage

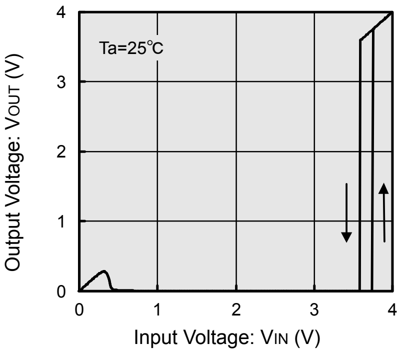
XC61CN1802 (1.8V)



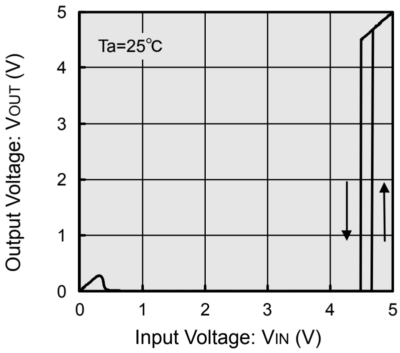
XC61CN2702 (2.7V)



XC61CN3602 (3.6V)



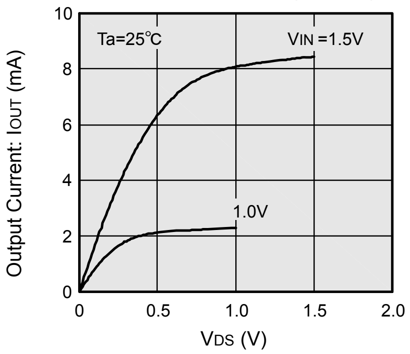
XC61CN4502 (4.5V)



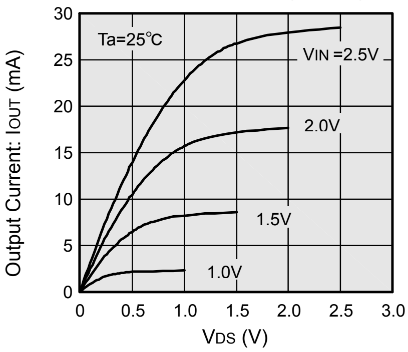
Note : The N-ch open drain pull up resistance value is 100kΩ.

(4) N-ch Driver Output Current vs. V_{DS}

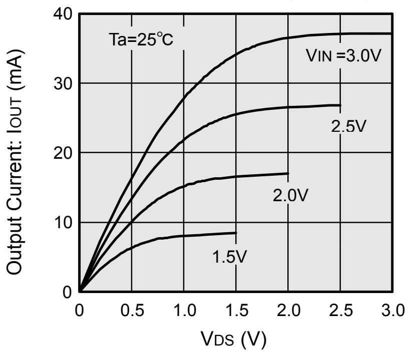
XC61CC1802 (1.8V)



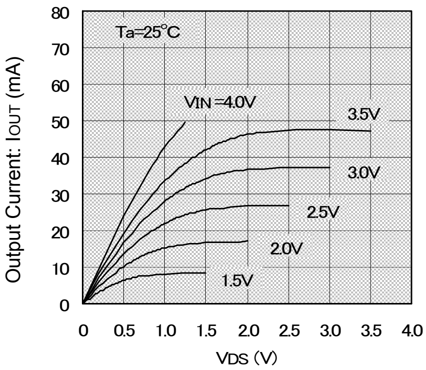
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)



XC61CC4502 (4.5V)

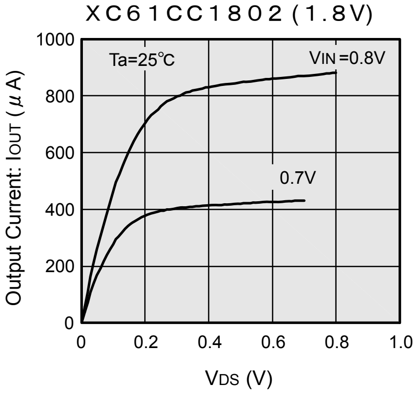


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

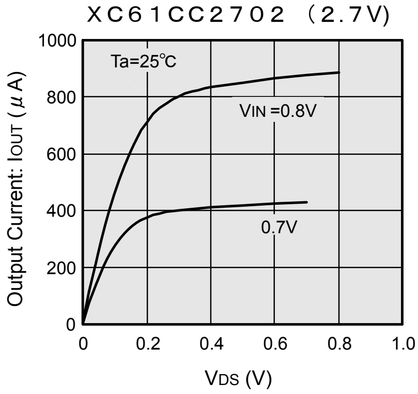
●Standard Voltage (Continued)

(4) N-ch Driver Output Current vs. VDS

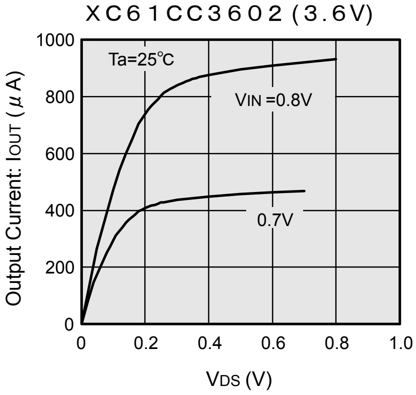
XC61CC1802 (1.8V)



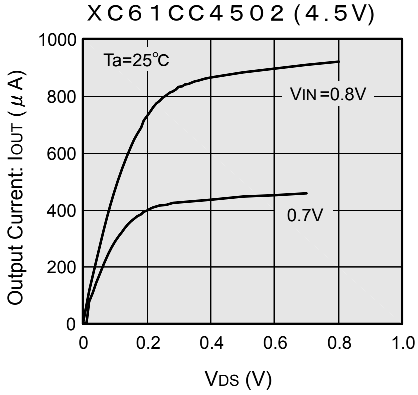
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)

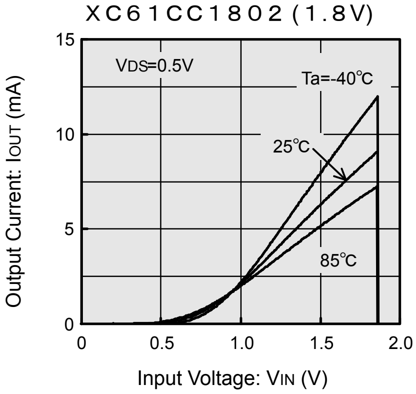


XC61CC4502 (4.5V)

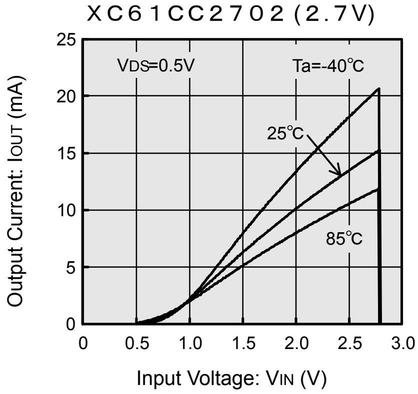


(5) N-ch Driver Output Current vs. Input Voltage

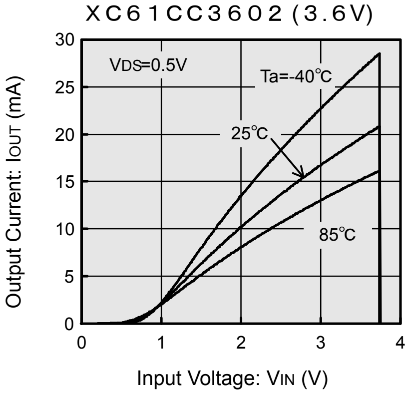
XC61CC1802 (1.8V)



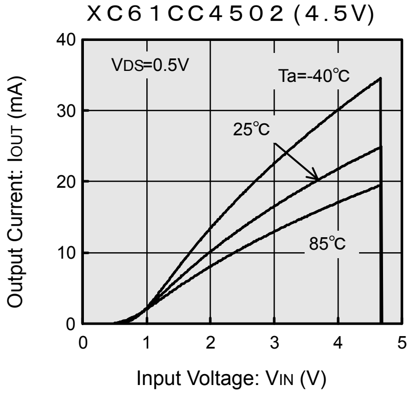
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)



XC61CC4502 (4.5V)

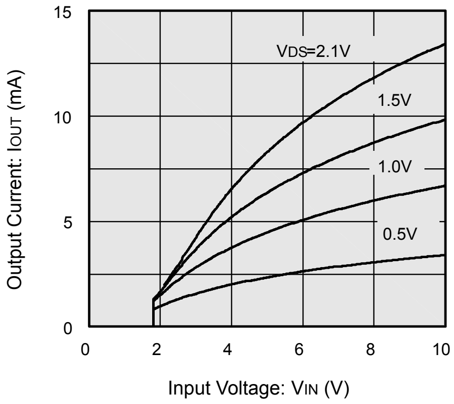


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

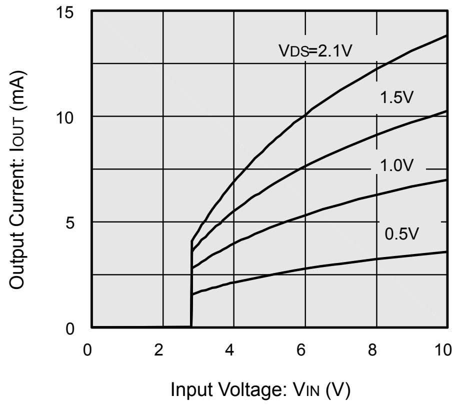
●Standard Voltage (Continued)

(6) P-ch Driver Output Current vs. Input Voltage

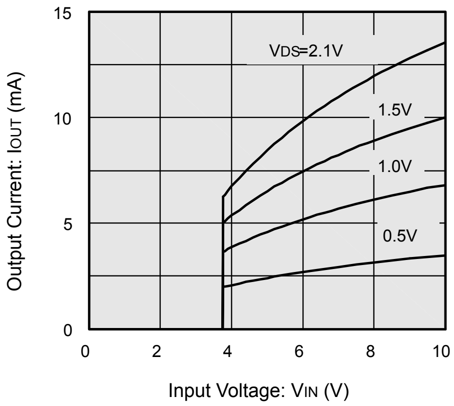
XC61CC1802 (1.8V)



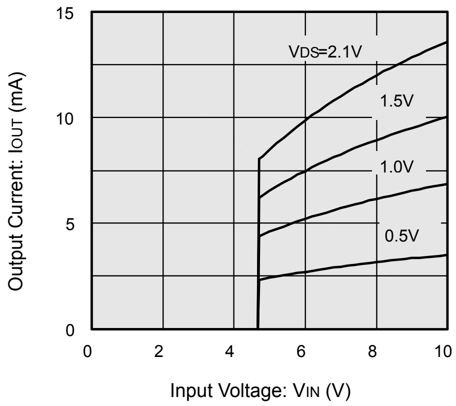
XC61CC2702 (2.7V)



XC61CC3602 (3.6V)

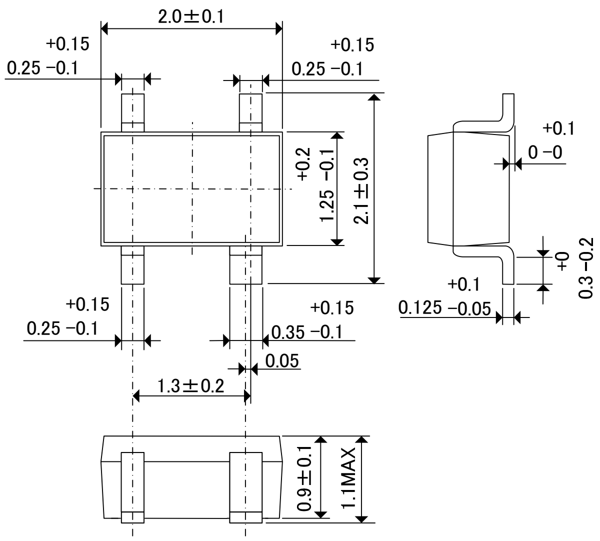


XC61CC4502 (4.5V)

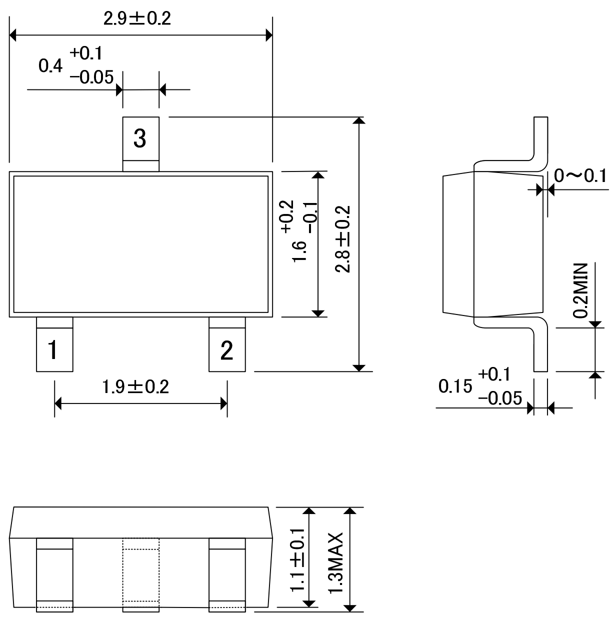


■PACKAGING INFORMATION

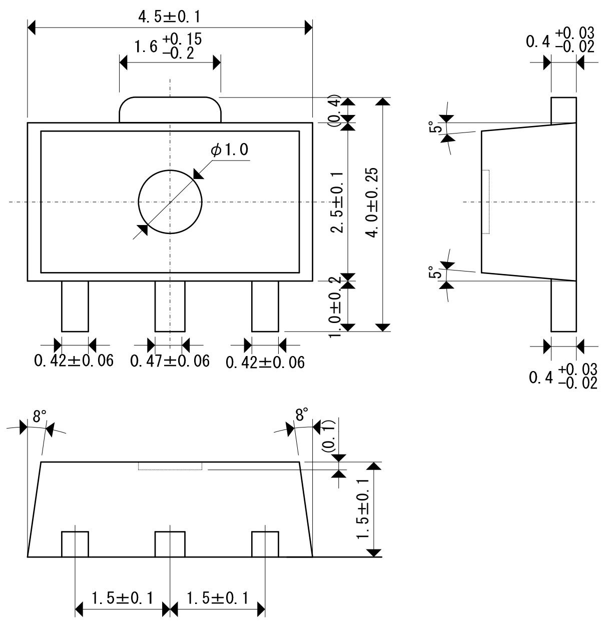
●SSOT-24



●SOT-23



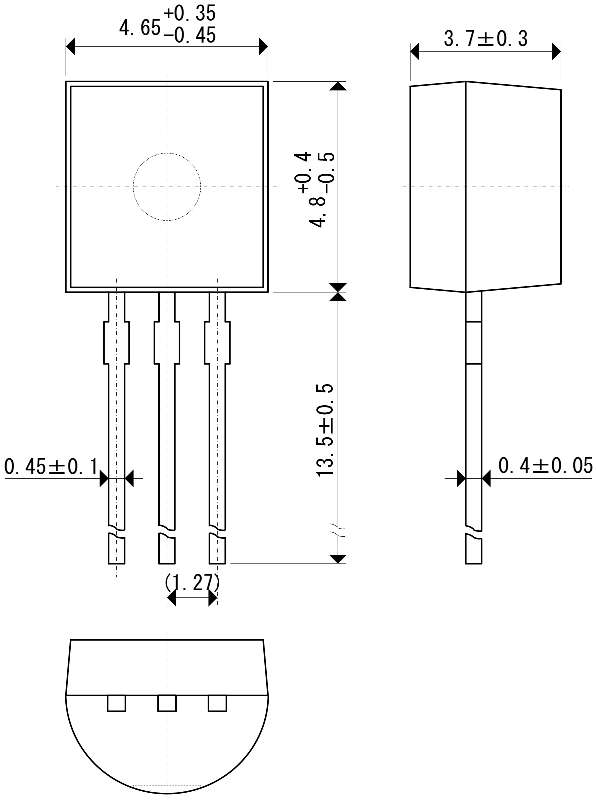
●SOT-89



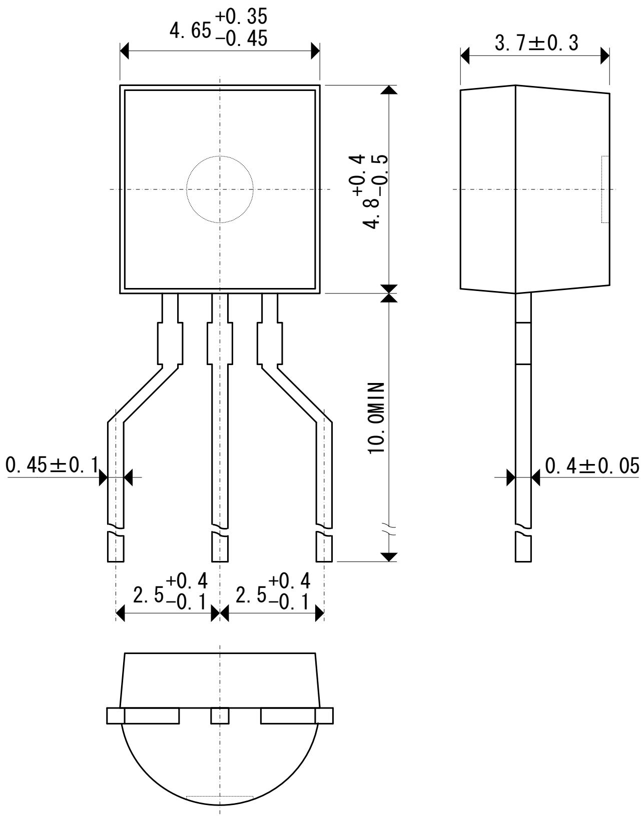
■PACKAGING INFORMATION(Continued)

●TO-92

●TB TYPE

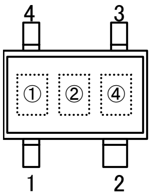


●TH TYPE

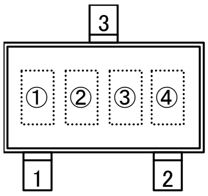


■MARKING RULE

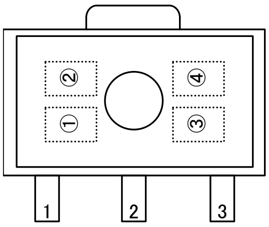
● SSOT-24, SOT-23, SOT-89



SSOT-24 (SC-82)
(TOP VIEW)



SOT - 23
(TOP VIEW)



SOT - 89
(TOP VIEW)

① represents integer of detect voltage and
CMOS Output (XC61CC series)

MARK	CONFIGURATION	VOLTAGE (V)
A	CMOS	0.X
B	CMOS	1.X
C	CMOS	2.X
D	CMOS	3.X
E	CMOS	4.X
F	CMOS	5.X
H	CMOS	6.X

N-Channel Open Drain Output (XC61CN series)

MARK	CONFIGURATION	VOLTAGE (V)
K	N-ch	0.X
L	N-ch	1.X
M	N-ch	2.X
N	N-ch	3.X
P	N-ch	4.X
R	N-ch	5.X
S	N-ch	6.X

② represents decimal number of detect voltage

MARK	VOLTAGE (V)	MARK	VOLTAGE (V)
0	X.0	5	X.5
1	X.1	6	X.6
2	X.2	7	X.7
3	X.3	8	X.8
4	X.4	9	X.9

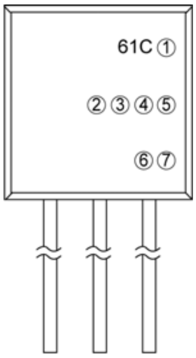
③ represents delay time
(Except for SSOT-24)

MARK	DELAY TIME	PRODUCT SERIES
3	No Delay Time	XC61Cxxx0xxx

④ represents production lot number
Based on the internal standard. (G, I, J, O, Q, W excluded)

■MARKING RULE (Continued)

●TO-92



TO-92
(SIDE VIEW)

① represents output configuration

MARK	OUTPUT CONFIGURATION
C	CMOS
N	N-ch

②, ③ represents detect voltage (ex.)

MARK		VOLTAGE (V)
②	③	
3	3	3.3
5	0	5.0

④ represents delay time

MARK	DELAY TIME
0	No delay

⑤ represents detect voltage accuracy

MARK	DETECT VOLTAGE ACCURACY
1	Within ± 1% (Semi-custom)
2	Within ± 2%

⑥ represents a least significant digit of production year

MARK	PRODUCTION YEAR
5	2005
6	2006

⑦ represents production lot number
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)
* No character inversion used.

1. The products and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date.
2. We assume no responsibility for any infringement of patents, patent rights, or other rights arising from the use of any information and circuitry in this datasheet.
3. Please ensure suitable shipping controls (including fail-safe designs and aging protection) are in force for equipment employing products listed in this datasheet.
4. The products in this datasheet are not developed, designed, or approved for use with such equipment whose failure of malfunction can be reasonably expected to directly endanger the life of, or cause significant injury to, the user.
   (e.g. Atomic energy; aerospace; transport; combustion and associated safety equipment thereof.)
5. Please use the products listed in this datasheet within the specified ranges.
   Should you wish to use the products under conditions exceeding the specifications, please consult us or our representatives.
6. We assume no responsibility for damage or loss due to abnormal use.
7.

TOREX SEMICONDUCTOR LTD.